

The Mental Status Expert (MSE): An Expert System for Scoring and Interpreting the Mental Status Examination

Daniel B. Hier, M.D., Chiang S. Jao, Ph.D. and Steven U. Brint, M.D.
Department of Neurology, University of Illinois, Chicago, IL 60612-7330

ABSTRACT

The mental status examination is the most difficult and time-consuming portion of the neurological examination. A complete mental status examination requires the examiner to assess alertness, memory, language, praxis, gnosis, attention, and visual-spatial functions. Findings of the mental status need to be interpreted in terms of severity of deficits, nature of the deficits, likely etiology, and likely area of corresponding brain injury. The performance of an accurate, complete, and detailed mental status examination is a daunting task for the medical student or resident in training. Traditional mental status examinations show considerable inter-examiner variability for items administered and for interpretation of abnormalities. Even in academic settings, mental status examinations have little educational content.

We have developed an expert system to assist neurologists and other physicians in the scoring, interpretation, and reporting of the mental status examination. Our goal was to build an expert system with following desirable characteristics: (1) Encourage the use of a standardized protocol of mental status examination and minimize examiner's variability in the tests administered; (2) Score the patient's performance according to pre-determined normative data; (3) Use production rules to determine the presence of mental status deficits so as to minimize examiner's bias in the diagnosis of deficits; (4) Generate an attractive and legible consultation in text and graphics to convey findings; (5) Provide the user access to a stored knowledge-base of interpretative information that would enhance the educational content of the consultation; (6) Store patient findings in a database to allow future retrieval as well as analysis of aggregate data.

We designed a standardized mental status examination that sampled the following aspects of higher cortical functions: Alertness and Concentration (orientation, level of alertness, spell WORLD backwards); Language (naming, repetition, comprehension); Left Parietal Function (right-left discrimination, finger gnosis, calculating, writing, motor praxis); Right

Parietal Function (dressing, drawing, neglect, extinction); Occipital Lobe Function (color naming, reading); Memory (recall); Frontal Lobe Function (verbal fluency, oral praxis, executive functioning). The standardized mental status examination was printed and then administered manually by examiners.

We designed a hypermedia-based expert system for patient registration and report writing. The system is implemented in KnowledgePro for Windows® (KPWIN). KPWIN is a rule-based expert system shell with object-oriented programming and hypermedia capabilities. The former capabilities reduced the complexity of program design and the latter ones allowed us to build an intuitive user interface with a minimum of screen clutter.

The Mental Status Expert (MSE) allows the user to input information in ten areas: Patient Demographics, Patient History, Basic Neurological Examination, Alertness/Orientation, Language, Left Parietal Lobe Function, Right Parietal Lobe Function, Frontal Lobe Function, Occipital Lobe Function, Memory, and Miscellaneous Functions. A button bar at the bottom of each screen allows the user to page forward/backward, quit, print the consultation, store findings in the database, or access an on-line reference library. The on-line reference library adopts a portion of text from *Topics in Behavioral Neurology* (Hier DB, Gorelick PB, Shindler AG; Butterworths Publishers, 1987). The MSE displays a paragraph of explanatory text about each chosen mental status deficit that can either be viewed on the screen or printed to be appended to the consultation. The MSE uses production rules (1) to decide the severity of deficits displayed in a bar chart; (2) to create a deficit summary to list all deficits currently diagnosed; (3) to retrieve explanatory text about any deficits diagnosed. The user may then append any further interpretative text he/she wishes to add. Patient findings are stored in a database file. This provides a permanent searchable record of the consultation for either review purposes or statistical analysis.